# Hand Flexor Tendon Injuries Involving the A2 and A4 Pulleys in Rock Climbers

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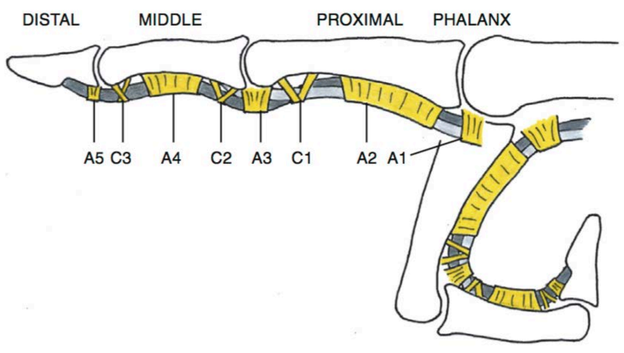
## Introduction

An otherwise uncommon injury is prevalent in the climbing community

- Approximately 1.6% of Americans participate in the sport of Rock Climbing (5 million people)[1]
- Soft tissue strain in the upper extremity is intensified while climbing.
- Approximately 40% of all reported climbing injuries occur at the A2 and A4 pulleys of the flexor tendons[2,5]
- Mechanism of injury is predictable
  - Closed crimp hand position
  - Repetitive motion
  - Excess force
  - Acute loading




## Key Questions

How can the injury be treated conservatively?

How can Chiropractors work to rehab this injury, and work with athletes to prevent further injury?

- Many climbers prophylactically tape their digits attempting to prevent injury however this method has proved ineffective[3]
- Climbing with a ”closed” crimp as opposed to an open crimp yields higher rate of injury.
- As technology for climbing equipment improves, people are training harder and climbing more technical routes. Fall related injuries are less common, but soft tissue injuries are more common.

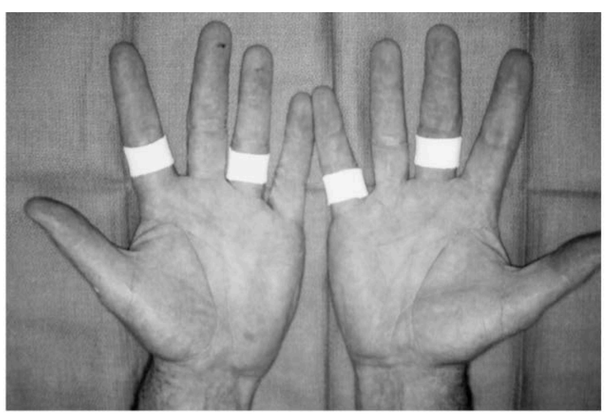


**Figure 1.** The taping sequence for five pairs of hands. The other four pairs of hands had the index and ring fingers of the right hand and the middle and small fingers of the left hand taped.

## Discussion

- The crimp grip position is unique to rock climbing

- The hand position induces up to 116N of force on the A2 pulley, and 30N of external force at the finger tip
- A study on cadaveric hands shows the resulting tear and bowstringing of pulley tendons after acute loading [4]

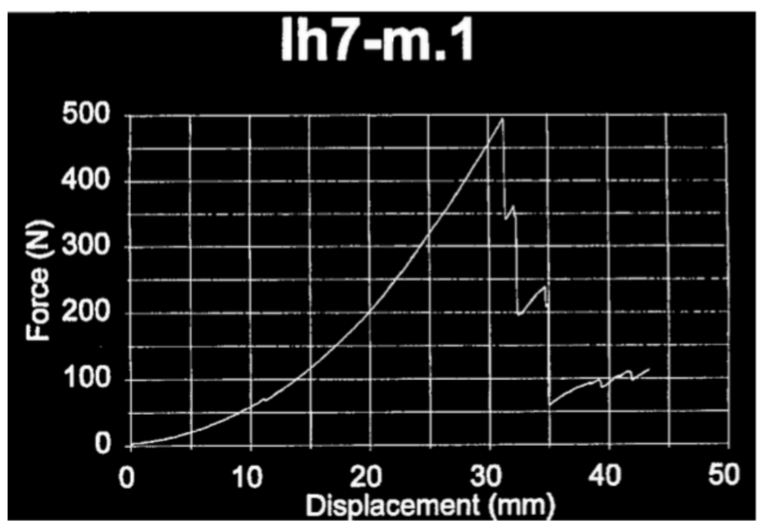
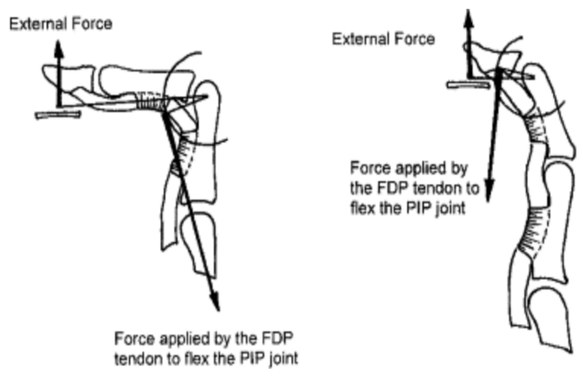
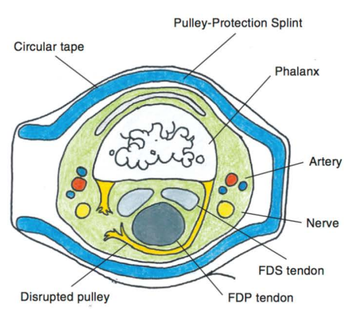



**Figure 4.** This curve represents a failure of the A3 and A4 pulleys at 494 N followed by A2 pulley failure at 362 N. Terminally, the flexor digitorum superficialis tendon avulsed at 35 mm of displacement.

- Pulley ruptures most commonly affect the A2 and A4 sheaths, often in the third and fourth digit. [2-7]




- Training modification and prevention of initial injury is paramount in building strength to tendons, and minimizing recovery time in the case of injury.
- A pulley protector splint provides optimal immobilization of the pulleys [2]




## Treatment Protocols

- Initial treatment includes NSAIDs, ice, and some occupational modalities
- Immobilization of the pulley for 2-6 weeks
- Gradual loading of the finger in flexion; climbing can begin at six weeks past injury, beginning on less than vertical walls.
- Crimp grips should be avoided until finger strength is at 80% or more [6]
- Oppositional stretching as part of rehab strengthens extensor muscles
- Soft tissue therapies have shown effective on muscular and tendinous structures and may increase blood flow to the area[8,9]
- Graston, Massage, ART

## Conclusion

- Prevention of injury is paramount
- As a community, climbers benefit from chiropractic care, as well as many other soft tissue treatment

## References

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